We claim:

1. A method for producing biocompetent fibrinogen comprising:

providing a first DNA segment encoding a secretion signal operably linked to a heterologous fibrinogen Aα chain,

the DNA segment comprising genomic DNA encoding the Aα chain;

a second DNA segment encoding a secretion signal operably linked to a heterologous fibrinogen Bβ chain,

the DNA segment comprising genomic DNA encoding the Bβ chain; and

a third DNA segment encoding a secretion signal operably linked to a heterologous fibrinogen γ chain,

the DNA segment comprising genomic DNA encoding the γ chain,

wherein each chain is from the same species, and wherein each of said first, second and third segments is operably linked to additional DNA segments required for its expression in the mammary gland of a host female mammal;

introducing said DNA segments into a fertilized egg of a non-human mammalian species heterologous to the species of origin of said fibrinogen chains;

inserting said egg into an oviduct or uterus of a female of said mammalian species to obtain offspring carrying said DNA segments;

breeding said offspring to produce female progeny that express said first, second and third DNA segments and produce milk containing biocompetent fibrinogen encoded by said segments;

collecting milk from said female progeny; and

and recovering the biocompetent fibrinogen from the milk.

2. A method according to claim 1 wherein said species into which said DNA segments are introduced is selected from the group consisting of sheep, pigs, goats, and cattle.

3. A method according to claim 1 wherein each of said first, second and third DNA segments comprises an intron.

4. A method according to claim 1 wherein the molar ratio of said first, second and third DNA segments is within the range of 0.5–1:0.5–1:0.5–1.

5. A method according to claim 1 wherein each of said first, second and third DNA segments is operably linked to a transcription promoter selected from the group consisting of casein, β-lactoglobulin, α-lactalbumin and whey acidic protein gene promoters.

6. A method according to claim 1 wherein said first, second and third DNA segments are expressed under the control of a β-lactoglobulin promoter.

7. A method according to claim 1 wherein said introducing step comprises injecting said first, second and third DNA segments into a pronucleus of said fertilized egg.

8. A method according to claim 1 wherein said fibrinogen is human fibrinogen.

9. A method according to claim 1 wherein said second DNA segment comprises a sequence of nucleotides as shown in SEQ ID NO: 3 from nucleotide 470 to nucleotide 8100.

10. A method according to claim 1 wherein said second DNA segment comprises a sequence of nucleotides as shown in SEQ ID NO: 3 from nucleotide 512 to nucleotide 8100.

11. A method according to claim 1 wherein said species into which said DNA segments is introduced is sheep.

12. A method of producing biocompetent fibrinogen comprising:

incorporating a first DNA segment encoding a secretion signal operably linked to an Aα chain of fibrinogen into a β-lactoglobulin gene to produce a first gene fusion comprising a β-lactoglobulin promoter operably linked to the first DNA segment

, the DNA segment comprising genomic DNA encoding the Aα chain;

incorporating a second DNA segment encoding a secretion signal operably linked to a Bβ chain of fibrinogen into a β-lactoglobulin gene to produce a second gene fusion comprising a β-lactoglobulin promoter operably linked to the second DNA segment

, the DNA segment comprising genomic DNA encoding the Bβ chain;

incorporating a third DNA segment encoding a secretion signal operably linked to a γ chain of fibrinogen into a β-lactoglobulin gene to produce a third gene fusion comprising a β-lactoglobulin promoter operably linked to the third DNA segment

, the DNA segment comprising genomic DNA encoding the γ chain,

wherein each of said first, second and third segments are of the same species;

introducing said first, second and third gene fusions into the germ line of a non-human mammal so that said DNA segments are expressed in a mammary gland of

said mammal or its female progeny and biocompetent fibrinogen is secreted into milk of said mammal or its female progeny;

obtaining milk from said mammal or its female progeny; and

recovering said fibrinogen from said milk.

13. A method according to claim 12 wherein said mammal is a sheep, pig, goat or cow.

14. A method according to claim 12 wherein each of said first, second and third gene fusions comprises an intron.

15. A method according to claim 12 wherein the molar ratio of said first, second and third gene fusions introduced is within the range of 0.5–1:0.5–1:0.5–1.

16. A method according to claim 12 wherein said introducing step comprises injecting said first, second and third gene fusions into a pronucleus of a fertilized egg and inserting said egg into an oviduct of a pseudopregnant female to produce female offspring carrying said gene fusions in the germ line, wherein said egg and said pseudopregnant female are of the same species.

17. A method according to claim 12 wherein said mammal is a sheep.

18. A method for producing biocompetent fibrinogen comprising:

providing a transgenic female non-human mammal carrying in its germline heterologous

genomic

DNA segments encoding Aα, Bβ and γ chains of fibrinogen, wherein said segments are expressed in a mammary gland of said mammal and biocompetent fibrinogen encoded by said segments is secreted into milk of said mammal;

collecting milk from said mammal; and

recovering said biocompetent fibrinogen from said milk.

19. A method according to claim 18 wherein said mammal is a sheep, pig, goat or cow.

20. A method according to claim 18 wherein said mammal is a sheep.

21. A transgenic non-human female mammal that produces recoverable amounts of biocompetent human fibrinogen in its milk, wherein said mammal comprises:

a first DNA segment encoding a secretion signal operably linked to a heterologous fibrinogen Aα chain,

the DNA segment comprising heterologous genomic DNA encoding the Aα chain;

a second DNA segment encoding a secretion signal operably linked to a heterologous fibrinogen Bβ chain,

the DNA segment comprising heterologous genomic DNA encoding the Bβ chain;

and

a third DNA segment encoding a secretion signal operably linked to a heterologous fibrinogen γ chain.

the DNA segment comprising heterologous genomic DNA encoding the γ chain;

and

further wherein each chain is derived from the same species and is operably linked to additional DNA segments required for its expression in the mammary gland of a host female mammal.

22. A mammal according to claim 21 wherein said mammal is a sheep.

23. A process for producing a transgenic offspring of a mammal comprising:

providing a first DNA segment encoding a secretion signal operably linked to a heterologous fibrinogen Aα chain.

the DNA segment comprising genomic DNA encoding the Aα chain;

a second DNA segment encoding a secretion signal operably linked to a heterologous fibrinogen Bβ chain.

the DNA segment comprising genomic DNA encoding the Bβ chain;

and a third DNA segment encoding a secretion signal operably linked to a heterologous fibrinogen γ chain.

the DNA segment comprising genomic DNA encoding the γ chain,

wherein each chain is derived from the same species, and wherein each of said first, second and third segments is operably linked to additional DNA segments required for its expression in the mammary gland of a host female mammal;

introducing said DNA segments into a fertilized egg of a non-human mammalian species heterologous to the species of origin of said fibrinogen chains;

inserting said fertilized egg into an oviduct or uterus of a female of said mammalian species; and

allowing said fertilized egg to develop thereby producing transgenic offspring carrying said first, second and third DNA segments, wherein female progeny of said mammal express said DNA segments in a mammary gland to produce biocompetent fibrinogen.

24. A process according to claim 23 wherein said offspring is female.

25. A process according to claim 23 wherein said offspring is male.

26. A non-human mammal produced according to the process of claim 23.

27. A non-human mammal according to claim 26 wherein said mammal is female.

28. A non-human female mammal according to claim 27 that produces milk containing biocompetent fibrinogen encoded by said DNA segments.

29. A non-human mammal according to claim 26 wherein said mammal is male.

30. A non-human mammal carrying in its germline

heterologous genomic

DNA

segments encoding human Aα, Bβ and γ chains of fibrinogen, wherein female progeny of said mammal express said DNA segments in a mammary gland to produce bio-competent human fibrinogen.

31. A mammal non-human according to claim 30 wherein said mammal is female.

32. A mammal non-human according to claim 30 wherein said mammal is male.

33. A mammal according to claim 30, wherein said mammal is a sheep.

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34. A set of DNA sequences comprising:

a first DNA segment encoding a secretion signal operably linked to a heterologous fibrinogen Aα chain, the DNA segment comprising genomic DNA encoding the Aα chain;

a second DNA segment encoding a secretion signal operably linked to a heterologous fibrinogen Bβ chain, the DNA segment comprising genomic DNA encoding the Bβ chain; and

a third DNA segment encoding a secretion signal operably linked to a to a heterologous fibrinogen γ chain, the DNA segment comprising genomic DNA encoding the γ chain, wherein each chain is from the same species, and wherein each of said first, second and third segments is operably linked to additional DNA segments required for its expression in the mammary gland of a host female mammal.